

APRIL/MAY 2024

**DOPH25A/GOPH25A — SPECTROSCOPY  
AND LASERS**

Time : Three hours

Maximum : 75 marks



**SECTION A — (10 × 2 = 20 marks)**

Answer ALL questions.

- How are molecules classified according to rotational spectra?
2. What is the cause of hyperfine structure in rotational spectra?
  3. What are hot bands seen in IR spectra?
  4. What are the different types of normal modes of vibration?
  5. Mention the condition for a molecule to be Raman active?
  6. Why Anti-stokes lines are less intense than Stokes lines?
  7. What do you understand by Threshold condition?
  8. What is the role of optical resonator in lasers.



9. What is optical pumping?

10. Compare the wavelength and power of laser emitted from Nd-YAG and CO<sub>2</sub> laser.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Obtain an expression for the rotational energy of a diatomic rigid rotator.

Or

(b) Write a note on symmetric and asymmetric top molecules.

12. (a) Explain the anharmonicities in IR spectra using Morse curve.

Or

(b) Explain the principle of FTIR spectroscopy.

13. (a) Compare the rotational Raman spectra and vibrational Raman spectra.

Or

(b) Outline the applications of Raman spectroscopy.

14. (a) Discuss the characteristics of laser.

Or

(b) Explain the phenomenon of stimulated emission.

15. (a) Briefly discuss excitation mechanism in gas lasers.

Or

(b) Compare Solid state lasers and Gas lasers.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Explain the working of a microwave spectrometer with a block diagram.

17. Describe the normal modes of CO<sub>2</sub> and H<sub>2</sub>O molecules.

18. Briefly discuss the quantum theory of Raman effect.

19. Obtain Einstein's A and B coefficients, and thus explain the condition for producing Laser.

20. With neat sketch explain the construction and working of Ruby Laser.

